The LNS Superconducting Cyclotron: measured B-fields compared to 3D simulations

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Abstract: The Superconducting Cyclotron (CS) is a compact three-sectors AVF cyclotron in operation since 1994 in the South National Laboratory (LNS), Catania. The operating magnetic field of this machine is between 22 and 48 Kgauss, and the maximum energy is 100 MeV/amu for Q/A=0.5. A modification of ferromagnetic circuit (field shimming in the extraction region) has been studied, in order to increase the final energy of the extracted beam until 120 MeV/amu. A large part of this work has been devoted to the fields simulation of the present structure of the CS. The OPERA 3-D software by Vector Fields was used. Detailed 3-D magnetostatic models of the CS have been constructed, in order to accurately simulate the very complex machine geometry. All important features of the cyclotron such as the pole geometry, the central plug geometry, the yoke structure, etc.. have been described with a very high precision level in order to obtain a very good agreement between the calculations and the measurements of the magnetic fields for the whole operating diagram of the accelerator. Results of TOSCA (magnetostatic module of OPERA 3-D) calculations compared to measurements are presented.